CONTENTS

1. SCOPE

1.1 Content. This document establishes the general manufacturing and testing requirements for hybrid microcircuits. Detail requirements, specific characteristics of hybrids, and other provisions that are sensitive to the particular use intended shall be specified in the applicable detail specification. This document is intended to provide a level of quality and reliability suitable for the acquisition of non-Qualified Parts List (QPL) hybrids for JPL Mission Class A and B applications; it is not intended for qualification of parts or for certification as defined by MIL-H-38534, or for listing on an approved parts list.

2. APPLICABLE DOCUMENTS

2.1 Government documents. This specification is based on the Class K, option 2, requirements of MIL-H-38534, which are incorporated herein by reference. This document delineates changes to the MIL-H-38534 requirements which shall apply to the hybrids manufactured for JPL. Other exceptions will be defined as needed in the detail specifications or in the procurement document. The contractor may contact the JPL contract technical manager or the JPL buyer to obtain copies of this document.

SPECIFICATIONS

Military

MIL-H-38534A	Hybrid Microcircuits, General Specification for

2.1.1 Exceptions. References to the U.S. Government and its agencies shall be taken to refer to JPL (e.g., JPL Quality Assurance (QA) source inspection shall be substituted for GSI). References to "JAN", "QPL", and "qualified" do not apply. The detail specification shall be the JPL detail specification.

3. REQUIREMENTS

Requirements of Paragraph 3 apply with the exception of the following:

3.1 General

3.1.1 Device Procurement Specification. Delete.

3.1.2 Conflicting requirements. Delete items a. through c. and substitute as follows:

a. Procurement document (contract or purchase order).

b. Applicable device specification (associated detail specification or drawing).

c. This specification.

d. Specification referenced in 2.1.

3.1.3 Terms, definitions, methods, and symbols. Modify as follows:

3.1.3.6 Delta ( ) limits. Delete and substitute as follows: "All deltas (whether expressed as absolute or percentage values) shall compare the measurement after burn-in with that recorded prior to the same burn-in."

3.1.3.18 Qualifying activity. Delete and substitute as follows: "The organization within JPL or its subcontractor that grants approval for acquisition of a particular product from a given manufacturer."

3.1.3.19 Acquiring activity (procuring activity). Add the following: "The acquiring activity shall be JPL or its subcontractor; the representative usually will be the JPL contract technical manager or contract negotiator."

Add paragraphs 3.1.3.23 through 3.1.3.25 as follows:

3.1.3.23 Control unit. A control unit is a part of the same device type, package, and manufacturer (but not necessarily the same lot) as the test specimens, but which is not subjected to any of the stresses that are applied to the test specimens. It is used to verify the repeatability of measurements.

3.1.3.24 Trace number. The trace number is the number assigned by the procurement document to link a part number to a specific purchase order or Order Release.

3.1.3.25 Contract technical manager. The contract technical manager shall be the principal technical interface between the manufacturer and JPL.

3.2 Item requirements

3.2.1 Country of manufacture. Delete.

3.3 Classification of requirements

3.3.1 Certification of conformance and acquisition traceability. Modify as follows:

a. (3) Product assurance level need not be recorded.

3.4 Quality assurance requirements. Add the following: "The Option 2 quality assurance requirements for Class K shall be applied."

3.4.1 Certification and qualification. Delete and substitute as follows: "While Certification in accordance with MIL-STD-1772 is preferred, a survey by JPL quality assurance may be substituted. In the latter case, JPL QA personnel will perform a survey to ascertain general compliance with the quality assurance program requirements of Appendix A and certification shall mean approval by JPL of a manufacturer for acquisition of a family of devices. Information regarding recent DESC audits, if any, shall be provided upon request. (Product qualification is not required by Option 2.)"

3.4.2 Element evaluation. Add paragraph 3.4.2.2 as follows:

3.4.2.2 Radiation hardness assurance. Hybrid microcircuits are considered to meet a specific Radiation Hardness Assurance (RHA) level if all dice used in the manufacture of the hybrids are acquired from wafers that have passed Quality Control Inspection (QCI) to that RHA level, or a higher level. Where dice from wafers which have passed radiation test are unavailable, a sample of the dice to be used shall be packaged and tested in accordance with the requirements of MIL-STD-883, Method 5005, Group E (substituting for Method 1019 the text of "MIL-STD-883, Proposed Method 1019.4" dated 1/28/91 except that the dose rate (paragraph 3.5) shall be 100 rads (Si)/s). The manufacturer may elect to replace the element testing by testing of completed hybrids. The lot definitions, sampling procedures, and test methods of MIL-M-38510 and MIL-STD-883, Method 5005, Group E, may be applied as an alternate test plan. The manufacturer shall perform the tests unless the detail specification or procurement document requires that JPL do so. Type of test (which subgroup(s) of Group E), radiation levels, and applicable electrical parametric limits will be defined in the detail specification.

3.4.2.2.1 Procedure when manufacturer performs radiation testing. The manufacturer shall make available to the JPL contract technical manager for review and approval by the JPL radiation test group a proposed radiation test plan prepared in accordance with Method 1019.4. The manufacturer shall assemble test devices from each of the wafers intended for use in the hybrid and test in accordance with the appropriate Group E methods of MIL-STD-883 Method 5005 (substituting the 1/28/91 draft of Method 1019.4). Electrical measurements shall be made at the specified points. If the yield is insufficient for the quantity of hybrids on order, the manufacturer shall notify the JPL contract technical manager and contract negotiator.

3.4.2.2.1.1 Procedure for MOS devices. Time Dependent Effects (TDE) testing in accordance with paragraph 3.10 of MIL-STD-883 Method 1019.4 (proposed, dated 1/28/91) is required for Metal Oxide Semiconductor (MOS) devices. Test samples for TDE which have not been burned in shall receive 48 hours of pre-irradiation burn-in at 125°C. In addition, the post-irradiation measurement requirements of Method 1019.4 paragraph 3.9 shall be revised such that measurements following each irradiation must be completed within 1 hour of the end of irradiation.

3.4.2.2.2 Procedure when JPL performs radiation testing. The manufacturer shall assemble test devices from each wafer intended for use in the hybrid, perform room temperature electrical test (preceded by a 48-hour burn-in at 125°C if TDE testing is planned), and deliver the test devices to JPL to the attention of the contract technical manager. The latter will advise of the acceptability of each of the wafers upon completion of testing.

3.4.5 Quality conformance inspection (QCI). Add: "The acquiring activity shall mean the JPL contract technical manager. The requirements for delivery do not apply to cases where prior shipment is required herein (e.g., Destructive Physical Analysis (DPA) samples and catastrophic failures)."

3.4.7 Configuration control.

3.4.7.1 Class I, major changes. "The JPL contract technical manager" shall be substituted for "the acquiring activity" to be notified prior to implementation of any major change.

3.6 Marking of microcircuits. Delete requirement to mark with the manufacturer's designating symbol (item e) and certification mark (item i).

3.6.2 PIN. Delete and substitute as follows:

3.6.2 Part number. Add as follows: "The basic pattern shall be as follows:

33333-X33333YR

where:

33333	identifies the detail specification (5 digits only, excluding the "ST" or "PT" prefix)
X	identifies the JPL descriptor code for the device family (X is for crystal oscillators).
33333	is the generic or manufacturer's catalog part number (or a part thereof)
Y	indicates the general package style: D = dual in-line (DIP) F = flat-pack

P = diamond-based cans (TO-3, TO-66)
T = TO-5, TO-18, TO-39 type cans
Y = special: See detail specification

R identifies the level of TID testing which the lot passed (identified in para. 3.6.8.4)

3.6.8 Special marking

3.6.8.4 RHA designator. Substitute as follows: "Radiation hardness designators shall be marked on the part as indicated in the acquisition documents and herein. RHA designators shall refer to total dose only and shall be assigned as follows: asterisk (*) indicates irradiation levels not standard to M38510.

M = 3 krads
D = 10 krads
N = 15 krads*
S = 20 krads*
P = 50 krads*
Q = 75 krads
R = 100 krads
T = 150 krads*
W = 200 krads*
H = 1,000 krads
X,Y = unassigned: refer to detail specification.

Add paragraph 3.6.8.5 as follows:

3.6.8.5 Life test part identifier. Devices which successfully pass the Group C.2 life test and subsequent seal tests shall have the letter "Q" added as a suffix to the lot number marking.

3.7 Workmanship.

3.7.2 Rework and repair provisions.

3.7.2.7 Delidding of devices. Delete and substitute as follows: "No delidding for rework or repair is permitted without prior approval by the JPL contract technical manager."

Add paragraphs 3.8 through 3.11 as follows:

3.8 JPL review of manufacturer's documentation. The manufacturer shall make available the following items for review and approval by the JPL contract technical manager prior to use with their respective JPL lots:

a. Lot traveler(s) for each device type (covering assembly, screen, and QCI operations).

b. Electrical test program and data recorded from a device of the specified type taken over the full specified temperature range.

c. Bench test procedures, if applicable.

d. Radiation test plan, if applicable.

3.9 Problem notification. The contractor shall notify the JPL contract technical manager and contract negotiator within two working days of the occurrence of any of the following:

a. Any catastrophic failure after initial electrical test.

b. Any Percent Defective Allowable (PDA) or pattern failures, including failures which appear to result from equipment failure or operator error.

c. Any QCI failure.

d. Any need for re-marking serial numbers.

e. Any case in which the number of wafers accepted in radiation testing is insufficient to yield the quantity of devices required by the procurement document.

f. Any need for delidding of devices.

g. Any element evaluation test failures which may impact the delivery schedule.

3.10 Status reporting. The contractor shall provide the JPL contract technical manager and contract negotiator every two weeks with a written or oral status report stating the current status (point on the lot traveler and quantity of parts in the lot) and expected ship date of each lot in process, and noting any significant problems.

3.11 DPA samples. The manufacturer shall ship to the attention of the JPL contract technical manager 5 samples (or 3 samples in the case of lots containing 50 parts or fewer) upon completion of final electrical test in screening. These DPA samples may be delta rejects and/or high- and low-temperature parametric rejects. The manufacturer shall continue processing of the lot. There is no lot jeopardy associated with the results of JPL's DPA unless a defect is found which is unacceptable under the terms of the procurement document.

4. QUALITY AND RELIABILITY ASSURANCE PROVISIONS

Requirements of paragraph 4 apply with the exception of the following:

4.1 Responsibility for inspection.

4.1.9 Customer source inspection for Class K devices. Delete and substitute as follows:

4.1.9 JPL source inspection for Class K devices. Delete and substitute as follows: "JPL source inspection shall be required on all hybrid devices procured to the requirements of this specification. The manufacturer shall notify JPL QA at least two working days in advance of the scheduled inspection time. Adequate inspection stations shall be provided for the JPL QA representatives. The inspection steps shall include as a minimum:

a. Perform visual inspection of elements and substrate and audit of element evaluation documentation prior to kitting for assembly.

b. Perform 100% visual inspection at preseal at each power specified.

c. Perform 100% visual inspection and audit of documentation at pre-ship. (This may be waived by technical direction from the JPL contract technical manager if QA personnel are not available.)

4.1.9.1 Optional inspections. JPL QA representatives shall have the option of performing surveillance at any of the points listed as items a through j of paragraph 4.1.9 and as needed to assure compliance with Appendix A.

4.1.9.2 Lot acceptance test report review. The manufacturer shall make available at the earliest possible time (and preferably at least two weeks prior to kitting) the element and substrate lot acceptance test reports, including the radiation test report(s) (if such testing is required), to the contract technical manager for JPL review and acceptance. The report(s) will

be returned to the manufacturer with JPL's disposition indicated, and shall be included with the data to accompany the devices at shipment. The manufacturer shall continue processing the lot.

4.3.2 Sampling.

4.3.2.1 Disposal of samples. Delete the last sentence and substitute as follows: "Samples used for Group C.2 life test shall be shipped to JPL. The manufacturer shall retain with the lot data any other samples used in QCI and radiation Lot Acceptance Test (LAT) for JPL lots."

4.3.4 Test method alternatives. Add the following: "Deviations must be approved in writing by technical direction from the JPL contract technical manager before testing is begun."

4.3.5 Procedure in case of test equipment failure or operator error. Modify as follows:

(a) Substitute the JPL contract technical manager for Government Source Inspection (GSI) and Quality Assurance Representative (QAR).

(b) Add: "JPL retains the option of performing any failure analysis: the manufacturer shall not do any analysis destructive of the part without prior consent of the JPL contract technical manager."

(c) Delete the following sentence: "If no challenge is made within the next working day, the error will be considered valid as recorded."

4.3.6 Test equipment verification

Add paragraph 4.3.6.1 as follows:

4.3.6.1 Control units. Three (3) control units shall be measured and recorded immediately before and after each set of electrical measurements of the test specimens. (It is preferred that the same control units be used for all JPL lots of the same device type.) Each set of control unit measurements shall be checked for consistency with the last prior set of control unit measurements before proceeding with testing of the lot. In the event of significant discrepancy between two sets of readings, corrective action (maintenance or re-calibration of the test equipment) and retest of control units shall be accomplished before proceeding with testing of the lot. Note that these control units shall be used for measurements during QCI and radiation tests as well as during screening.

4.5 Screening. Add the following: "Screening rejects (including Particle Impact Noise Detection (PIND) rejects) which are not catastrophic electrical rejects shall be collected, identified as to which test was failed, and retained at the manufacturer's facility with the master set of lot data. The manufacturer will not, however, be required to submit these rejects to be counted by JPL QA inspectors."

4.5.1 Burn-in.

4.5.1.1 Failure analysis of burn-in screen failures for Class K devices. Delete and substitute as follows: "JPL retains the option to perform failure analysis of catastrophic failures, which are defined as follows:

a. Opens and shorts measurable or detectable at any specified temperature or voltage.

b. Any part which fails functional tests.

The contractor shall notify the JPL contract technical manager and contract negotiator within two working days of the occurrence of such failure or of a PDA or pattern failure.

4.5.1.3 Burn-in acceptance criteria. Add the following: "Resolution of electrical test data shall be equal to or better than 10% of the delta limit on that parameter."

4.6 Quality conformance inspection.

4.6.1 General. Add the following: "Option 2 of Table I Quality Assurance requirements shall be used. QCI test data, completed traveler, and sample devices used for Group C.2 life test shall be shipped to JPL. Any other QCI samples shall be retained by the manufacturer. The JPL contract technical manager shall be notified within two working days of any lot failure."

4.6.2 Quality conformance routines.

4.6.2.1 Option 1 (in-line inspection). Does not apply.

4.6.2.2 Option 2 (Method 5008).

4.6.2.2.2 Group B inspection. Add the following: "Subgroup 9, Electrostatic Discharge (ESD) test, shall be handled in accordance with MIL-H-38534 paragraph 3.6.8.2.

4.6.2.2.3 Group C inspection. Delete the first sentence and add the following: "The Group C tests required herein shall be performed on each inspection lot. Subgroup 2 life test parts shall be tested for fine and gross

leak in accordance with MIL-STD 883 Method 1014 after completion of the post-life test electrical measurements. There is no lot jeopardy associated with this hermeticity test."

4.6.2.3 Option 3 (Method 5005). Does not apply.

4.7 Data recording. Substitute the "JPL contract technical manager" for "acquiring activity."

4.7.1 Screening test data for Class K hybrid microcircuits. Delete the first sentence and substitute as follows: "The following data shall be included with each shipment of screened parts:

a. A copy of the completed lot traveler(s) used for screening and QCI.

b. A copy of attributes test data, including all element and device lot acceptance test reports, X-ray report and films, and any applicable radiation test data.

c. Electrical test data for all specified tests, including control unit data.

d. Data for any other special tests required by the detail specification or procurement document.

e. Copies of reports on any failure analyses, DPA, or engineering evaluations performed by the manufacturer.

f. Copies of any waivers or Technical Direction Memoranda (TDMs) altering the specified requirements.

If tests are labeled with test numbers, a cross-reference shall be provided to relate test numbers to descriptive test name (e.g., IIL, VOH) and pin number. It is preferred that printed electrical test data be formatted such that all measurements of a given parameter are displayed in a column, in serial number order. Electrical test data also shall be provided in a magnetic medium: either IBM DOS-compatible 5-1/4" or 3-1/2" diskette with data in ASCII format or 9-track tape (800 or 1600 bpi) with data in ASCII or EBCDIC format. (If the requirement for magnetic data is waived, two copies of printed data shall be provided.)"

5. PACKAGING

The requirements of paragraph 5 apply with the following additions:

5.1 Packaging requirements. All devices shall be handled as Class 1 for purposes of ESD protection unless specified otherwise. The initial container (unit package, e.g., tube or bag) shall be marked with the JPL trace number.

Add paragraph 5.2 as follows:

5.2 Packing slip and invoice. The packing slip and invoice shall include the JPL trace number associated with each line item.

5.3 Special marking of external shipping container. The external shipping container shall be marked "FLIGHT ELECTRONIC PARTS".

6. NOTES

Delete and substitute as follows:

6.1 Intended use. Hybrids conforming to this specification are intended for use when Class K qualified hybrids of adequate radiation hardness are not available. When a device has been qualified for Class K QPL listing, at an acceptable radiation hardness level, this specification shall not be used for new design and the QPL Class K product of the appropriate radiations hardness level shall be preferred for all applications.

6.2 Acquisition requirements. The acquisition document will specify the following:

a. Part number.

b. Associated detail specification number.

c. Any difference in test data requirements from those listed in 4.7.

d. Requirements for special carriers, lead lengths, lead finishes, or lead forming, if applicable.

e. Name and telephone number of JPL contract technical manager.

f. Name and telephone number of JPL contract negotiator.

g. Name and telephone number of JPL QA coordinator of source inspections.

h. JPL trace number.

i. Any special requirements which differ from those indicated herein or in the detail specification (e.g., those involving source inspections, traceability, radiation test, etc.).

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